self-taught, and executed fantasias chiefly remarkable for their disregard of every known rule of composition. Touches of family affection here and there relieve the intellectual pre-occupation lending its prevalent stamp to the Huygenian correspondence. One likes the great man better for his questions about the walking and talking achievements of his little niece, Gertruid Doublet, than for having solved the problem of the centre of oscillation, or discovered the isochronism of the cycloid. The maiden's modest proficiency was not carried to a high pitch. She died in 1665, at the age of four.

In the way of astronomy, Huygens did nothing of much moment during this interval. Admonished by Boulliaud of its visibility, he made his first observation of Mira Ceti at the Hague, on August 15, 1662, when it was nearly as bright as κ Ceti (fifth magnitude). The next account of the star is on September 15, three weeks at least after a maximum; and its declining state seemed to Boulliaud marked by the flaring and flashing of its light, as if in truth a semi-extinct conflagration revealed itself in his telescope. "C'est un spectacle," he adds, "à faire désespérer Aristote et ses disciples" ("Corr. de Huygens," t. iv. p. 231). Occasionally, too, Huygens pointed out the sustained conformity of the Saturnian appearances to his theory of them. The logic of fulfilled prediction had, indeed, by this time persuaded all but the few outstanders always averse to conviction by truth, that the hypothetical and the real systems were practically identical.

The two years embraced by the present section of this grand work were exceedingly peaceable ones. The gates of the Temple of Janus in the republic of letters remained fast shut as they slipped by. Scarcely a ripple of contention stirred. Everyone was in good humour, and carped at his rival's doings only *sotto voce*—a state of things peculiarly agreeable to our Batavian philosopher, who loved not to have his meditations broken in upon by the shrill outcries of wounded self-love. Could it but have continued! But that was not to be.

A. M. Clerke.

THE HORSE.

The Horse: A Study in Natural History. By William Henry Flower, C.B., F.R.S., &c. (London: Kegan Paul, 1891.)

IF there be a fault in the admirable little volume which Prof. Flower has contributed to the "Modern Science" series, it is that the author too cautiously withholds his opinion on certain broad biological questions in which not only naturalists but the general reading public are just now specially interested. Early in the first chapter, for example, we read:—

> "In many organs, but especially in the limbs and teeth, we find the strongest evidence of two opposing principles striving against each other for the mastery in fashioning their form and structure. We find *heredity*, or adherence to a general type derived from ancestors, opposed by special modifications of or derivations from that type, and the latter generally getting the victory, although in the numerous rudimentary structures that remain there is significant evidence of ancestral conditions long passed away. The various specializations, evidently in adaptation to purpose, will be thought by many to be the result of the survival, in the severe struggle for existence, of what is best fitted for the purpose to which it is to be applied. This may or may not be the explanation, but the interest of the study of such an animal as the horse will be increasd tenfold by the conviction that there is some true and probably discoverable causation for all its modifications of structure, however far we may yet be from the true solution of the methods by which they have been brought about."

Here natural selection is not so freely and fully accepted as many would wish. But the grounds of doubt are not indicated. On the other hand, use-inheritance fares worse. It is not so much as hinted at. It is well known that there are, especially in America, biologists of standing who contend that differentiations of structure are largely due to a Lamarckian factor in evolution; and they adduce specialization of tooth-structure and of limb-structure as evidence of the inherited effect of mechanical strains and stresses. Now, in the horse specialization in teeth and limbs has been carried far. The general public and not a few biologists would, we think, have been glad to learn the opinion of the Director of our National Museum as to the scientific value of such views in so far as they apply to the subject of his "study."

On another point of very general interest Prof. Flower does, however, express an opinion. It has been suggested that the horse has been separately evolved in America and in Europe through a parallel but not identical series of ancestral forms. The evidence for this hypothesis is generally regarded in this country as insufficient, and it is now held that the horse was probably evolved on the Western Continent. This is the view adopted, with his accustomed caution, by the author of this book.

> "It is," he says, "by no means impossible that America may have been the cradle of all the existing *Equidæ*, as it seems to have been of such apparently typical Old World forms as rhinoceroses and camels, and that they spread westward by means of the former free communication between the two continents in the neighbourhood of Behring's Straits, and, having prevailed over the allied forms they found in possession, totally disappeared from the country of their birth until reintroduced by the agency of man. This supposition, based upon the great abundance and variety of the possible ancestral forms of the horse which have lately been discovered in America, may be at any time negatived by similar discoveries in the Old World, the absence of which at the present time cannot be taken as any evidence of their non-existence."

The discovery in the Old World of ancestral Perissodactyles, in numbers at all comparable to those which have been found in America, would no doubt throw a flood of light on difficult questions of evolution and distribution. If, as Madame Marie Pavlow has suggested, Sir Richard Owen's *Hyracotherium* is (perhaps) identical with Prof. Cope's *Phenacodus*, similar genera have existed on either side of the Atlantic since early Eocene times. In both continents these early forms presumably left descendants. Between the primitive *Phenacodus* and the existing horse there are many intermediate forms, some of which seem to be generically identical in America and in Eurasia. Have there, then, been many successive migrations from the West? Have there been counter-migrations from East to West? What have been the relations between the indigenous descendants of *Hyracotherium* and the successively immigrant descendants of *Phenacodus?* These and other questions may possibly

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receive some sort of tentative answer through the researches of the palæontologists of the future. Prof. Flower is no doubt wise in not attempting to theorize on the subject; but this is the kind of question on which, in our experience, the "intelligent layman," whom the editor of the "Modern Science" series has in view, most greedily seeks information. Details of structure, no matter how clearly and lucidly described, do not appeal to him. He says, in effect, to the distinguished man of science: "My dear sir, from *you* I can take the details on trust; of them give me only sufficient to illustrate your methods of research: what I really want is your opinion on those broad general problems in which every man of liberal culture, who follows the thought of his time, must take a keen interest."

Prof. Flower divides his book into four chapters, of which the first deals with the horse's place in nature, and its ancestors and relations. The second chapter is devoted to the horse and its nearest existing relations. This contains a short account of the tapirs and the rhinoceroses, as well as the existing members of the horse tribe. The cuts with which it is illustrated are from photographs, and are admirable. The last two chapters (iii. and iv.) deal with the structure of the horse, chiefly as bearing upon its mode of life, its evolution, and its relation to other animal forms, the head and neck and the limbs being selected for detailed treatment.

Especially interesting are the paragraphs on the *ergot*, a roundish bare patch in the fetlock covered with rough thickened epidermis. It is suggested, and the suggestion is both valuable and interesting, that this represents

> "the palmar or plantar pads of those animals which walk more or less on the palm and sole. Owing to the modified position of the horse's foot, standing only on the end of the last joint of the one toe, this part of the foot no longer comes to the ground, and yet the pad with its bare and thickened epidermic covering, greatly shrunken in dimensions and concealed among the long hair around, and now apparently useless in the economy of the animal, remains as an eloquent testimony to the unity of the horse's structure with that of other mammals, and its probable descent from a more generalized form, for the well-being of whose life this structure was necessary."

Of the other callous patches, the so-called "chestnuts," or "mallenders" and "sallenders," which occur on the inner aspect in the fore-limb just above the "knee," and in the hind-limb just below the "hock," Prof. Flower says that their signification and utility are complete puzzles.

There are one or two misprints or inelegancies which will probably be removed in a second edition. On p. 52 we read: "The upper molars have a very characteristic pattern, admirably adapted for bruising and crushing coarse vegetable substances, and which is clearly a modification of the pattern," &c. Another redundant *and* before *which* occurs in the very awkward sentence on the top of p. 136. A somewhat quaint misprint occurs on the top of p. 68, where the "various species of the American general called *Merychippus* and *Protohippus*" are spoken of. One can imagine how the printer's devil prided himself on his knowledge of American proclivities. They give the name "general" even to an ancient fossil equine!

C. LL. M.

OUR BOOK SHELF.

A System of Sight-Singing from the Established Musical Notation, based on the Principle of Tonic Relation. By Sedley Taylor, M.A. (London: Macmillan and Co., 1891.)

THIS book is divided into two parts: (I.) the tonic sol-fa notation, (II.) the staff notation. Part I. differs from the "official" tonic sol-fa system only in the method of writing music in the minor key. Mr. Taylor is an out-and-out tonicist, and therefore most strongly opposed to the so-called "Lah mode" of the official system. It must be allowed that Mr. Taylor's method has the merit of consistency. For practical purposes, however, it is not so certain that the "Lah mode" is a mistake. At any rate, the opinion of most tonic sol-faists appears to be in its favour, as being the best method, from a utilitarian point of view, of treating the minor mode.

Part II. is an application of the tonic system to the ordinary staff notation. Mr. Taylor suggests that the line or space on which the tonic falls should be clearly marked by a thick line, of varying colours for major and minor keys. As long as there is little or no modulation in the music, there can be no objection to this, but when modulation sets in, the appearance which the stave assumes when these lines are inserted, becomes most puzzling. Two examples taken at random from the book will suffice to show this. In Ex. 142 the Do-line changes 6 times in the space of 9 bars of 2-4 time. Ex. 147, in 4-4 time, has 5 changes in as many bars.

It appears to us that these constant guides are calculated only to worry instead of directing the singer; "the graphic up-and-down-ness of the pitch-notation of the staff" (to use Mr. Taylor's words) seems to us to point out the way just as well without as with their assistance.

The book is most clear, logical, and interesting throughout; and whether one agrees with the reforms proposed in it or not, one cannot help feeling that the author, in his endeavours to minimize the difficulties of vocal music, deserves the thanks of all musicians.

The Statesman's Year-book for the Year 1892. Edited by J. Scott Keltie. (London: Macmillan and Co., 1892.)

THE "Statesman's Year-book" is too well known, and too highly appreciated, to need the commendation of reviewers. It presents such great masses of important facts, and these are generally so accurate and so well arranged, that the work has become indispensable to all who desire to obtain the latest information on the various subjects with which it deals. The changes for the year 1892 are described as "heavy and extensive," and all of them, we need scarcely say, add to the usefulness of the volume. The date of issue was somewhat later than usual; but it was well worth while to postpone publication, as the delay enabled the editor to include, among other valuable statistics, the results of the censuses of the leading countries of the world. This year the volume has been enriched with four admirably executed maps. They relate respectively to the density of the population of the globe on the basis of new censuses and estimates, the distribution of the British Empire over the globe, the partition of Africa, and the international frontiers on the Pamirs. These maps are most welcome, and will be of great service to all who may have occasion to refer to them.

The Optical Lantern as an Aid in Teaching. By C. H. Bothamley. (London: Hazell, Watson, and Viney, Limited, 1892.)

THOSE who wish to acquire a general knowledge with regard to the manipulation of an optical lantern, without

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